

# Per- and Polyfluoroalkyl Substances (PFAS) Detected in Groundwater at Brookhaven National Laboratory (DRAFT)

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# AGENDA

- What are Per- and Polyfluoroalkyl Substances (PFAS)?
- PFAS on Long Island
- PFAS Detection and Characterization on BNL Site
- Next Steps

# What are Per- and Polyfluoroalkyl Substances (PFAS)?

# What are PFAS?

- Per- and Polyfluoroalkyl Substances are a diverse group of compounds that are resistant to heat, water and oil
- Used in many industrial applications and consumer products
  - **Firefighting foam since 1960s. Used for Class B (hydrocarbon) fires**
    - Class B fires include flammable liquids or gasses, such as gasoline, solvents, propane
  - Teflon coated cookware
  - Stain resistant carpets
  - Fast-food wrappers and other paper products
  - Water resistant textiles
  - Semiconductor production

# What are PFAS?

- PFAS contamination is an emerging issue internationally
  - There have been >3,000 PFAS compounds developed
  - Products can contain mixtures of these compounds
  - In drinking water, the current focus is on six compounds, especially **PFOS** and **PFOA**
    - PFOS = Perfluorooctane sulfonate
    - PFOA = Perfluorooctanoic acid
  - Persist in soils and groundwater for long periods of time
  - Potential health effects
- PFOS/PFOA production in the US was phased out starting in the early 2000s due to environmental and health concerns

# Possible Health Concerns

- PFOS and PFOA have been studied, however many of the other PFAS compounds have not
- Primary route of entry appears to be ingestion of contaminated water, food or dust.
- Long biological half-life in humans: 8 years for PFOA; 5.4 years for PFOS; 72 hours for PFBA
- According to a recent ATSDR report, in highly exposed communities near PFAS manufacturers there are increased rates of:
  - Pregnancy induced hypertension
  - Increased cholesterol levels
  - Liver damage
  - Thyroid disease
  - Asthma
  - Decreased fertility
  - Developmental delays in fetuses and children
  - Considered a possible carcinogen by EPA and IARC. Increased risk of kidney and testicular cancer in highly exposed individuals (occupational exposures from manufacturing operations)
- Estimated to be present in blood of ~95% of the general US population

ATSDR = Agency for Toxic Substances and Disease Registry (part of DHHS)

IARC = International Agency for Research on Cancer

# PFAS on Long Island

# PFAS on Long Island

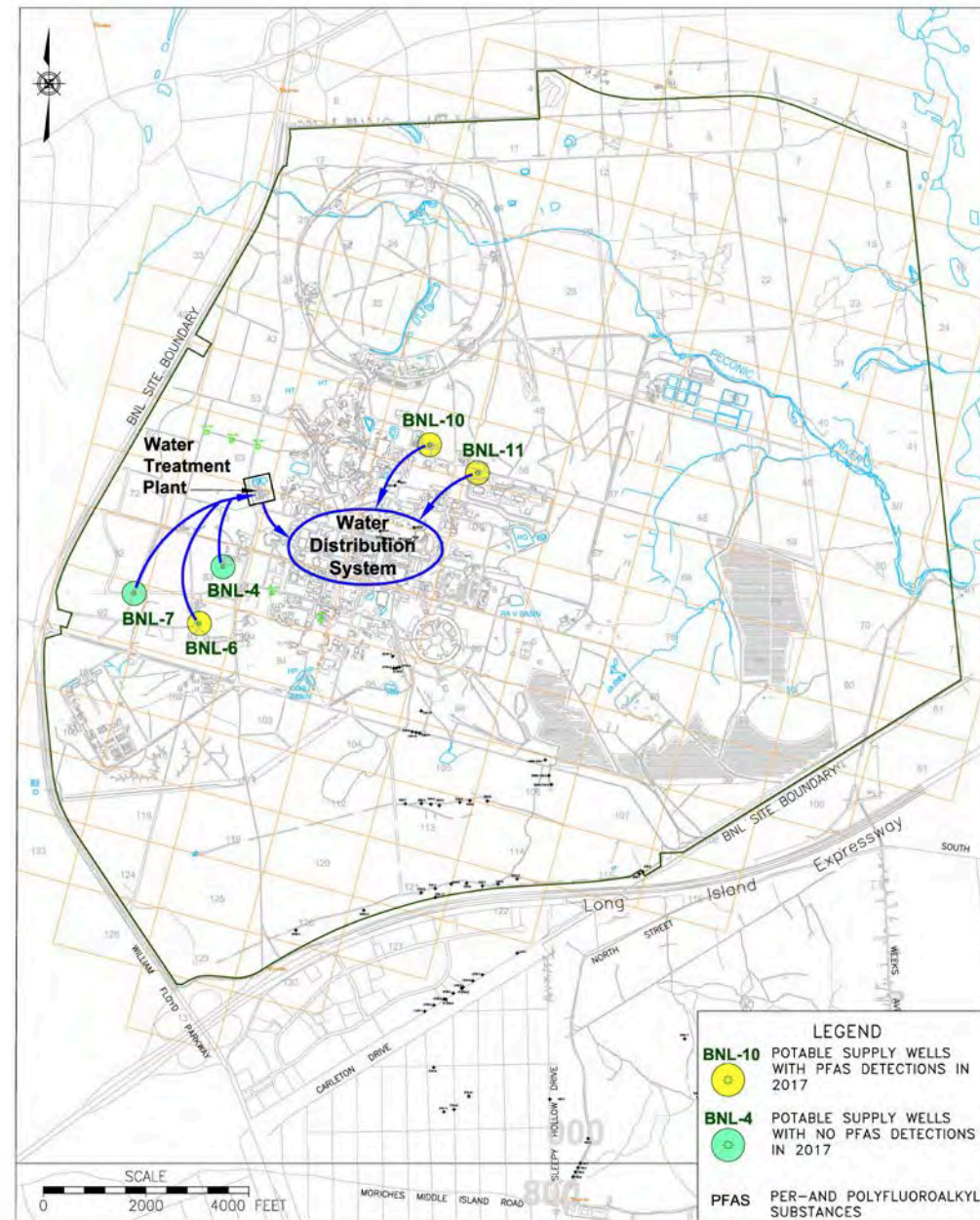
- Soil and groundwater contamination
  - Production and waste disposal
    - Production facilities (e.g., Hoosick Falls, NY)
    - Landfills (e.g., East Quogue, NY)
  - Use of firefighting foam
    - Airports
    - DOD facilities (possibly >600 sites)
    - Regional fire training facilities
    - Local Firehouses?
- PFAS detected in Long Island groundwater linked to firefighting foam, for example
  - Yaphank Fire Training Facility
  - Former Grumman Site - Calverton
  - Air National Guard Base at Gabreski Airport
  - East Hampton Airport
  - Islip MacArthur Airport?
- Water can be treated by using granular activated carbon filters



# PFAS Detection and Characterization on BNL Site

# 2017 Detection of PFAS in Groundwater at BNL

- Suffolk County tested water samples from BNL's potable water wells for PFAS
  - Tested for the six PFAS compounds evaluated under EPA's Safe Drinking Water Act program "Third Unregulated Contaminant Monitoring Rule"
- PFAS were detected in three of BNL's five active water supply wells.
  - Confirmed by analyzing multiple samples during 2017 and 2018
  - PFOS/PFOA concentrations
    - Wells 10 and 11: up to 27 ng/L
      - Most recent = 27 ng/L
    - Well 6: up to 70.4\* ng/L
      - Most recent = 33 ng/L
- EPA Lifetime Health Advisory Level for PFOS/PFOA = 70 ng/L
- Routine testing for PFAS was added to potable water monitoring program in 2018

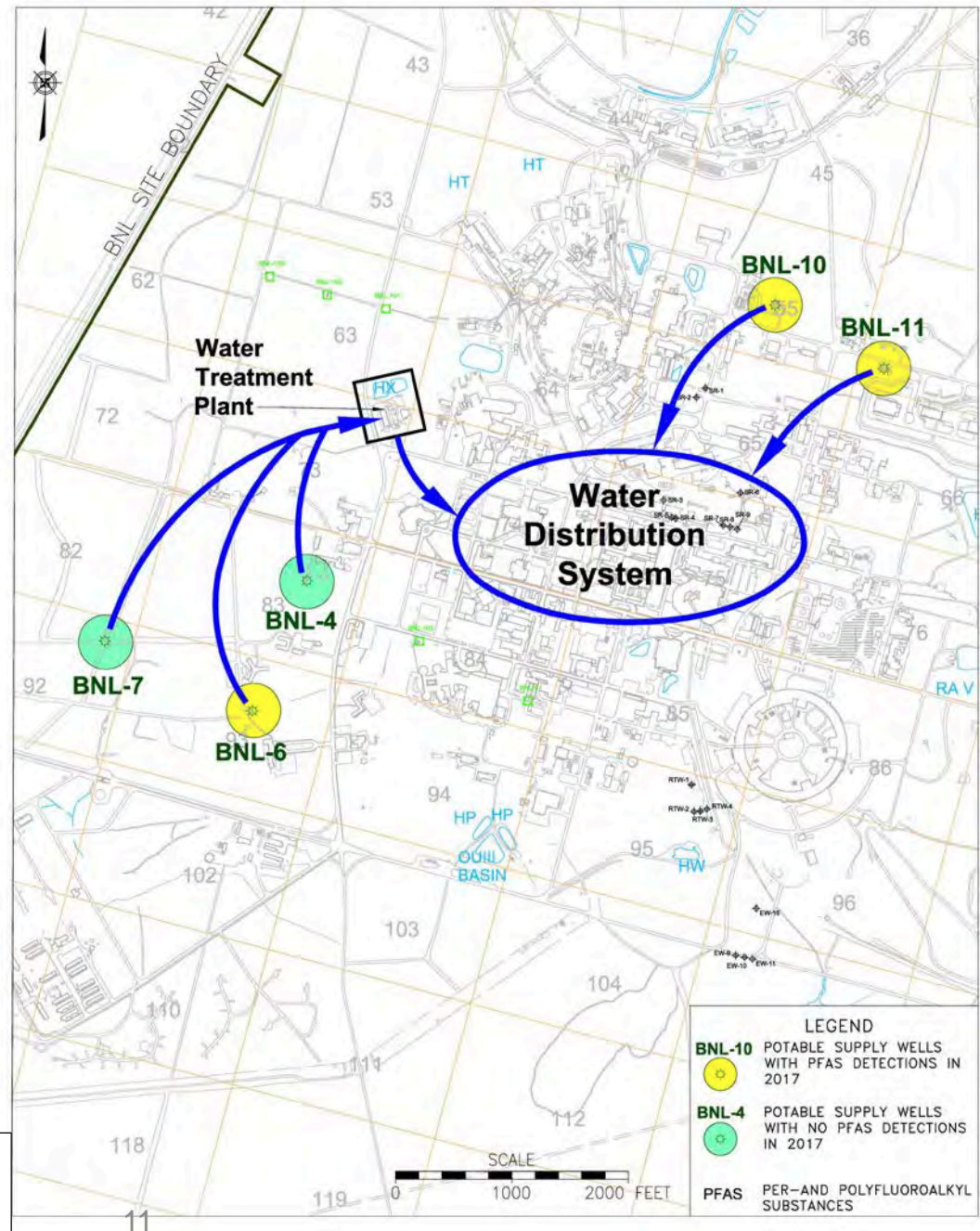


\*QA problems with analysis of the June 2018 sample that indicated 70.4 ng/L. All other samples have been <58 ng/L.



# Water Treatment and Distribution

- Water from wells 4\*, 6\*\* and 7 has naturally high levels of iron, and is first sent to the Water Treatment Plant to:
  - Reduce iron levels
  - Adjust the pH level (raised with addition of lime)
  - Chlorination for microbial control
  - Blending and the treatment process reduces PFOS/PFOA levels to <3 ng/L
- Water from wells 10 and 11 has low iron levels, and can be sent into the distribution system after:
  - pH adjustment
  - Chlorination



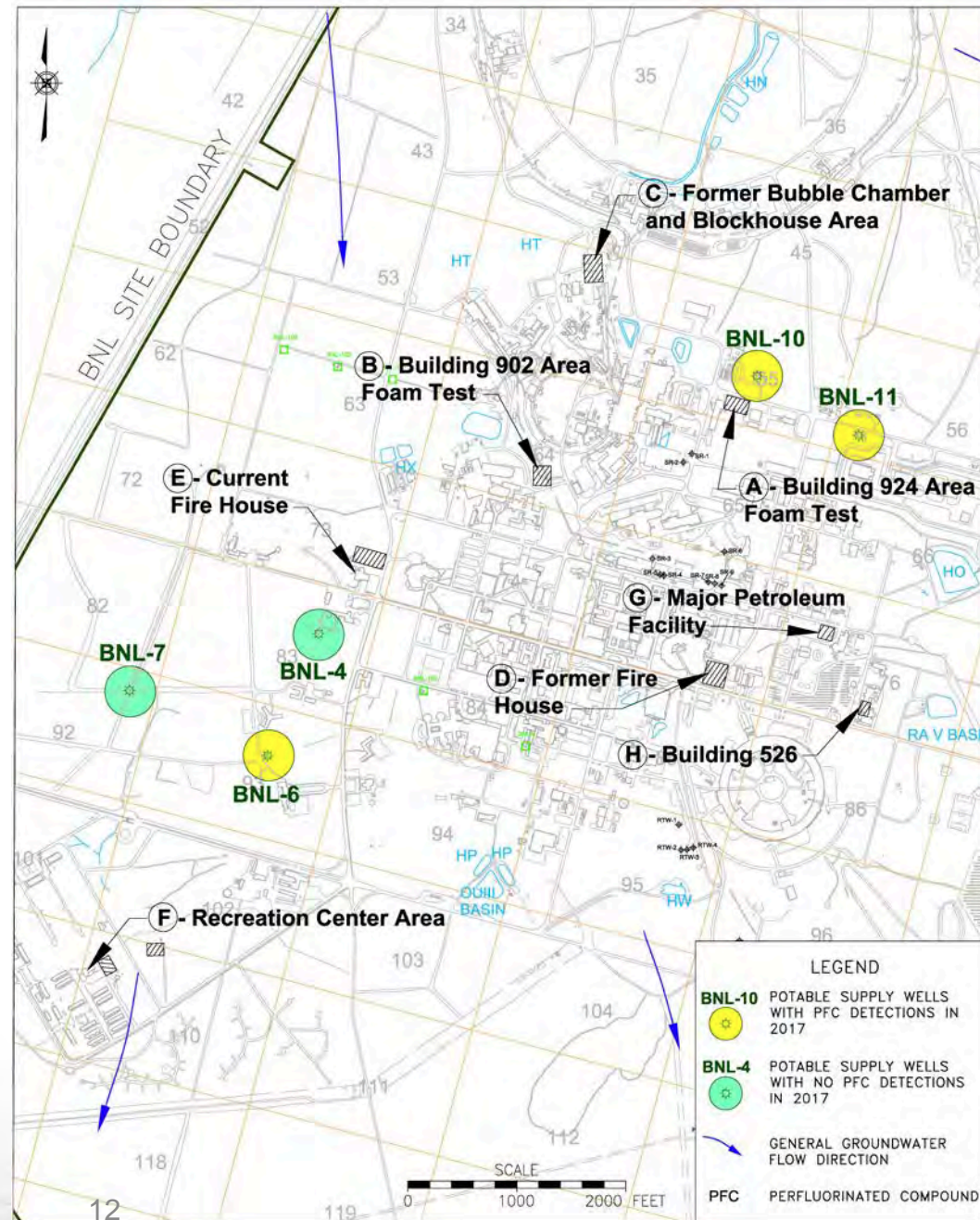
\*Well 4 has been used infrequently for the last five years and was removed from service July 24, 2018.

\*\*Well 6 was removed from service July 24, 2018.

# Source of PFAS = Firefighting Foam

Based upon review of available records and interviews with current long-term firefighters and retirees, foam was used for fire suppression systems and training:

- A. Trailer near Building 924 (1970)
- B. Area near Building 902 (1970)
- C. Former Bubble Chamber Experiment and Blockhouse Area (1973 [2 times], 1980)
- D. Former Firehouse (1966-1985)
- E. Current Firehouse (1986-2008)
- F. Recreation Center Area (1978, 1980)
- G. Major Petroleum Facility (1986)
- H. Building 526 (no known releases)





# Foam Chemistry

- Foam formulations for Class B Fires (examples)
  - Protein-based Foam: Biodegradable. Developed in 1940s
  - Fluoro-protein Foam and Aqueous Film-Forming Foam (AFFF): Developed in 1960s. Contained complex mixtures of PFAS (e.g., long carbon-chained fluorinated surfactants such as PFOS). These compounds help foam to spread over a fire
- Information on old foam formulations and amount used at BNL is not available
  - However, groundwater monitoring results indicate the foam contained PFOS/PFOA and other PFAS compounds
- Current inventory of Class B foam = Alcohol Resistant-AFFF
  - Doesn't contain PFOS/PFOA
  - Contains shorter carbon-chained fluorinated surfactants
    - Shorter environmental and biological half-life (but potential health and environmental effects are not well understood)
  - The foam is not used for training

## D: Former Firehouse Main Training Area - September 1966



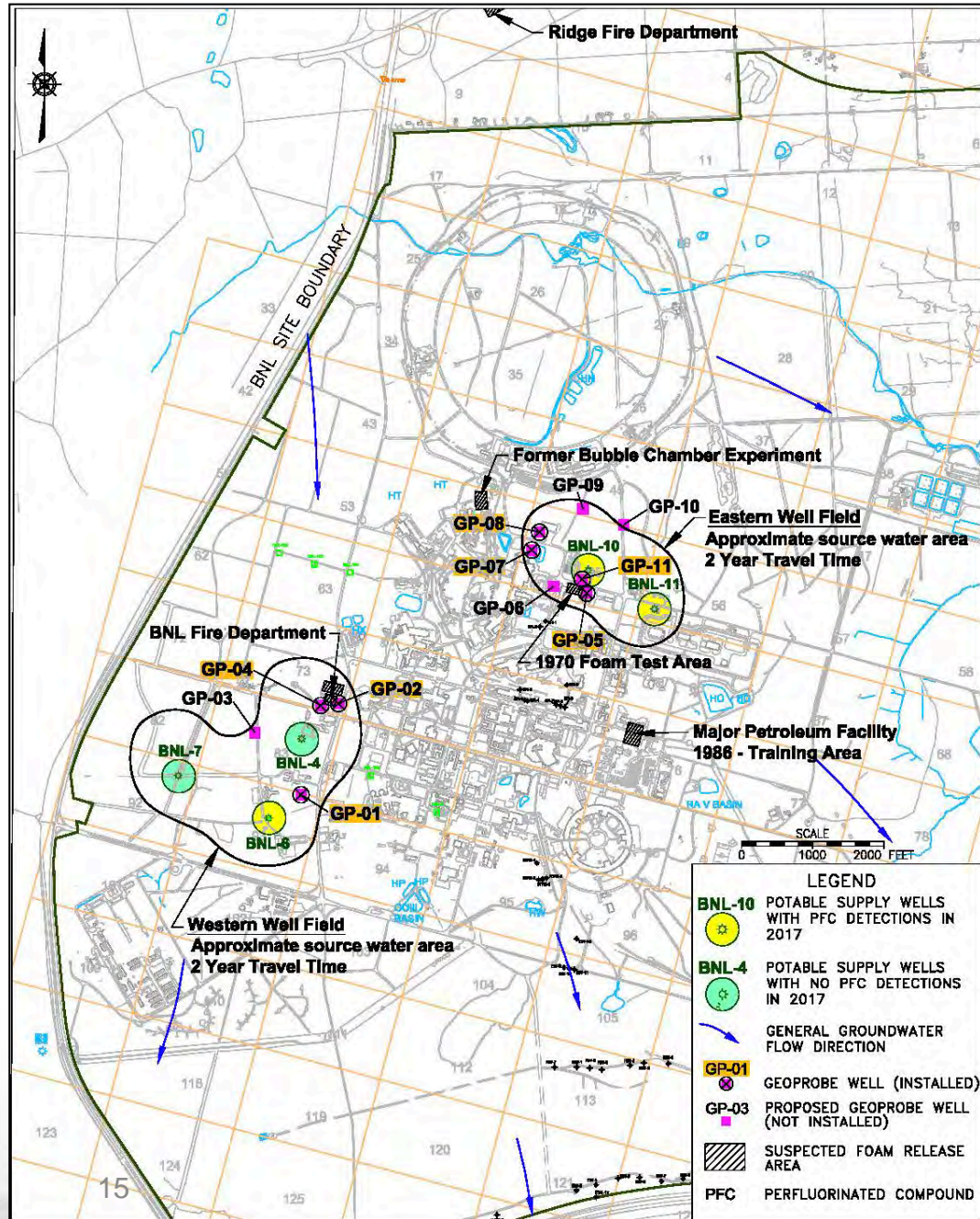


# PFAS

## Characterization

### Phase 1: Source Water Areas

- In May 2018, BNL installed 7 temporary wells. Objectives:
  - Determine the distribution and concentrations of PFAS within the source water areas
  - Determine whether PFAS concentrations could impact supply well operations
- Analyzed the samples for 21 PFAS
  - Requested by regulatory agencies
- Results:
  - PFOS/PFOA concentrations up to 3,124 ng/L
  - Other PFAS compounds were also detected
  - Highest concentrations were at the current firehouse (well GP-02)
  - These high concentrations will probably prevent the continued use of Supply Well 4 without treatment



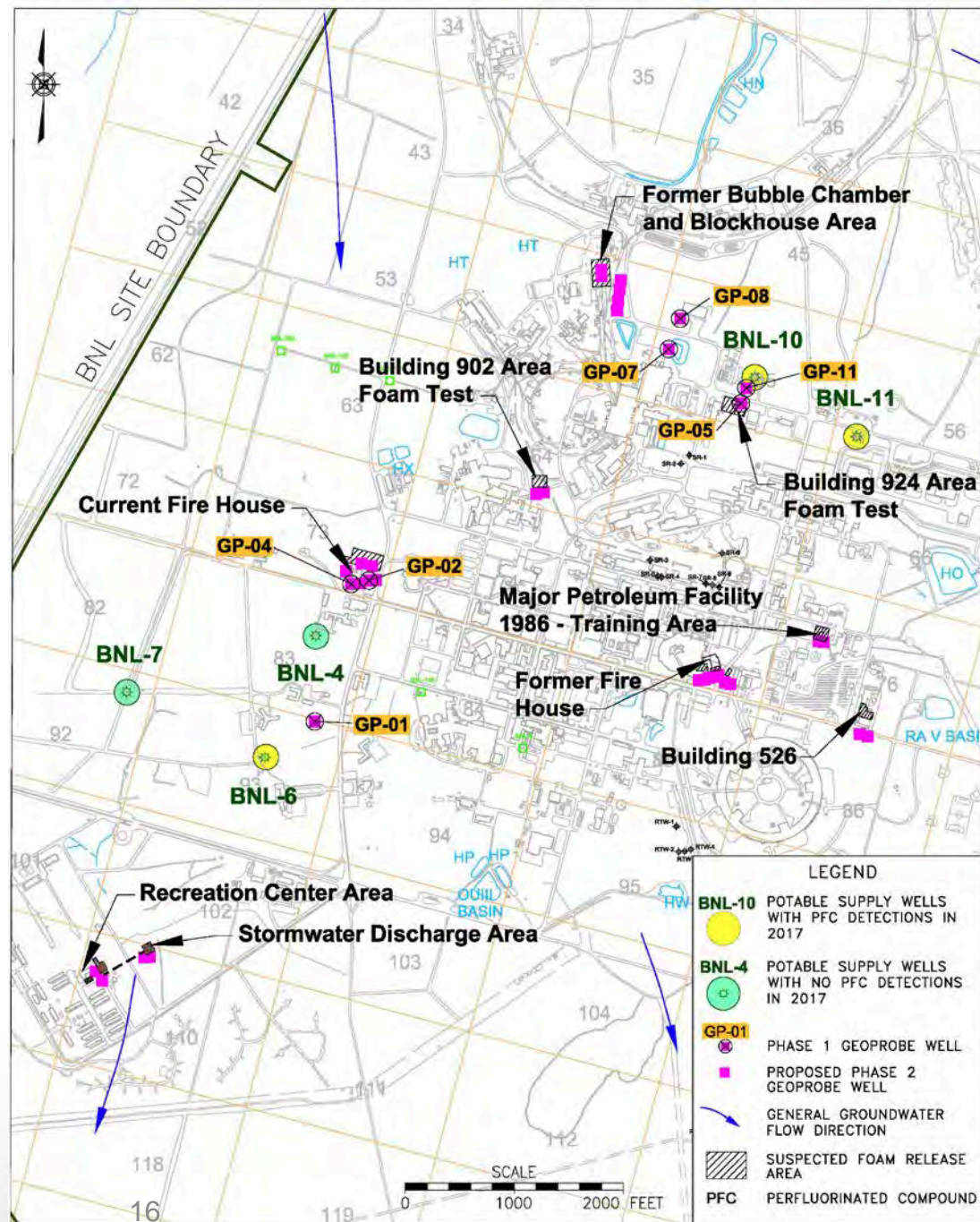


# PFAS

## Characterization

### Phase 2: Foam Release Areas

- Focus on foam release sites
  - Former Firehouse
  - Current Firehouse
  - Former Bubble Chamber Area
  - Building 902 Area Test Site
  - Recreation Center Area
  - Major Petroleum Facility
  - Building 526 Area
- To date, installed 20 of the planned 32 temporary wells.  
Available results:
  - Former Firehouse
    - PFOS/PFOA up to 5,400 ng/L
  - Recreation Center - Stormwater Discharge Area
    - PFOS/PFOA up to 31 ng/L





# Next Steps

# Next Steps

- Finish Phase 2 PFAS groundwater characterization – fall 2018
- Also planning to perform PFAS sampling from groundwater extraction wells and treatment systems, the Sewage Treatment Plant (STP) effluent, and monitoring wells downgradient of the two landfills and the STP
- Although PFOS/PFOA levels in drinking water are below the current health advisory level, BNL will proactively repair and return to service the activated carbon filters at potable Supply Well 11, then at Supply Well 10

# Next Steps

- In coordination with SCDHS, collect samples for PFAS analyses during routine annual sampling of five private wells south of BNL
  - This program of offering free annual testing of those private wells not connected to public water in the DOE-designated hook-up area has been ongoing since 2001
  - No contaminants from BNL have been identified in any of the homeowner's private wells. Contamination that originates from BNL is deeper than the water drawn from most typical homeowner wells in this area.
- NYS Drinking Water Council was commissioned to recommend drinking water standards for PFAS – schedule?
  - Possible that the NYS drinking water standard for PFOS/PFOA will be less than the current 70 ng/L EPA Health Advisory Limit (e.g., NJ = 14 ng/L for PFOA)
  - Unclear whether/when standards will be set for other compounds
  - Final standards could have a significant impact on future actions/requirements

# Stakeholder Communications

- U.S. Environmental Protection Agency ✓
- NY State Department of Environmental Conservation ✓
- Suffolk County Department of Health Services ✓
- Lab Employees ✓
- Brookhaven Executive Roundtable ✓
- Community Advisory Council
  - E-mail letter ✓
  - Meeting (October 11)